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PATENT ABSTRACTS OF JAPAN

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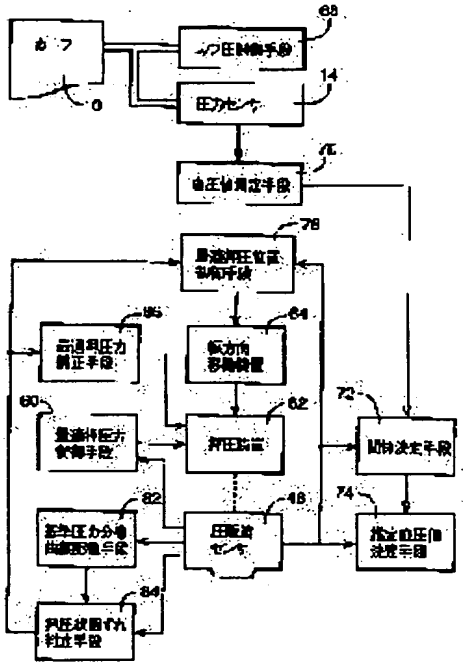
:) PRESSING-CORRECTING TYPE CONTINUOUS BLOOD PRESSURE MONITORING DEVICE

)Abstract:
OBLEM TO BE SOLVED: To provide a pressing-correcting type ıtinuous blood pressure monitoring device wherein a blood pressure nitoring precision is kept even when a slack on the fitting belt of a :ssure pulse wave sensor, and a habitual deformation or a recess at a :ssed area by the pressure pulse wave sensor are generated during a ıtinuous blood pressure monitoring.
LUTION: In a continuous blood pressure monitoring using an presumed od pressure, when it is judged that the pressing force of a pulse wave ısor 46 is shifted from an optimum pressing state by a pressing state ft judging means 84, the pressing force of the pulse wave sensor 46 is rrected in a manner to become optimum by an optimum pressing force rrecting means 86 under a state wherein the pressing surface of the se wave sensor 46 is kept at an optimum position by an optimum :ssing position control means 76. For this reason, the pressing force of pressure pulse wave sensor 46 to a wrist is optimized without starting optimum pressing position confirming operation, and an optimum :ssing force determining operation, and the blood pressure monitoring is ckly continued.



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AIMS

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aim(s)]
aim 1] The pressure pulse wave sensor which has two or more pressure sensing elements arranged crosswise [of this ry] in a press side in order to detect the pressure pulse wave generated from a living body's artery, The press ipment which presses this pressure pulse wave sensor toward an artery from on a living body's skin, An optimal ss force-control means to make said pressure pulse wave sensor press with this press equipment by the optimal thrust orehand determined that some blood vessel walls of said artery will serve as abbreviation flatness, and to maintain optimal thrust, It has a presumed blood-pressure value decision means to determine serially this living body's sumed blood-pressure value based on the magnitude of the pressure pulse wave detected by the pressure sensing nent of said pressure pulse wave sensor from the relation set up beforehand. It is continuation blood-pressure ervisory equipment which supervises said living body's blood-pressure value continuously with this presumed blood-ssure value. In the condition that the thrust of said pressure pulse wave sensor is maintained by said optimal thrust h said optimal press force-control means, and said living body's presumed blood-pressure value is determined by said sumed blood-pressure value decision means A press condition gap judging means by which the press condition over l artery of this pulse wave sensor judges the gap from the optimal press condition, When the gap from said optimal ss condition of the thrust to said artery of said pulse wave sensor is judged by this press condition gap judging means ss amendment mold continuation blood-pressure supervisory equipment characterized by including an optimal thrust endment means to amend the optimal thrust of said pressure pulse wave sensor currently pressed by said press ipment so that the gap from the optimal press condition may decrease.

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anslation done.]

TAILED DESCRIPTION

tailed Description of the Invention]
01]
dustrial Application] This invention is in the condition which is supervising a living body's blood-pressure value tinuously, and relates to the press amendment mold continuation blood-pressure supervisory equipment which ends the optimal thrust of the pressure pulse wave sensor currently maintained to the artery.
02]
scription of the Prior Art] The pressure pulse wave sensor which has two or more pressure sensing elements nged crosswise [of the artery] in a press side in order to detect the pressure pulse wave generated from a living ly's artery, An optimal press force-control means to make said pressure pulse wave sensor press with the press ipment by the optimal thrust beforehand determined that some of press equipment which presses the pressure pulse ve sensor toward the artery, and blood vessel walls of said artery will serve as abbreviation flatness, and to maintain optimal thrust, It has a presumed blood-pressure value decision means to determine serially the living body's sumed blood-pressure value based on the magnitude of the pressure pulse wave detected by the pressure sensing nent of said pressure pulse wave sensor from the relation set up beforehand. The continuation blood-pressure ervisory equipment which supervises said living body's blood-pressure value continuously with the presumed blood-ssure value is known. For example, the continuation blood-pressure supervisory equipment indicated by JP,8-'230,A etc. is it.
03]
oblem(s) to be Solved by the Invention] By the way, it sets within the continuation blood-pressure monitor period of above continuation blood-pressure supervisory equipment. According to concordance deformation of the skin of a ss part and the organization directly under the skin by which the slack of the wearing belt which has equipped the ng body with the pressure pulse wave sensor, and a pressure pulse wave sensor are made to press continuously, or a ression Though it was the press by the optimal thrust as which the beginning was determined, since shifting from the imal press condition occurred, there was inconvenience that the precision of monitor blood pressure fell.
04] The place which succeeds in this invention against the background of the above situation, and is made into the ect is to offer the press amendment mold continuation blood-pressure supervisory equipment with which blood-ssure monitor precision is maintained, even if the concordance deformation of a press part or the depression by slack l pressure pulse wave sensor of the wearing belt of a pressure pulse wave sensor occurs [be / it / under / continuation od-pressure monitor / setting].
05]
eans for Solving the Problem] The place made into the summary of this invention for attaining this object The ssure pulse wave sensor which has two or more pressure sensing elements arranged crosswise [of the artery] in a ss side in order to detect the pressure pulse wave generated from a living body's artery, The press equipment which sses the pressure pulse wave sensor toward an artery from on a living body's skin, An optimal press force-control ans to make said pressure pulse wave sensor press with the press equipment by the optimal thrust beforehand ermined that some blood vessel walls of said artery will serve as abbreviation flatness, and to maintain the optimal ust, It has a presumed blood-pressure value decision means to determine a living body's presumed blood-pressure ue serially based on the magnitude of the pressure pulse wave detected by the pressure sensing element of said ssure pulse wave sensor from the relation set up beforehand. It is continuation blood-pressure supervisory equipment ich supervises said living body's blood-pressure value continuously with the presumed blood-pressure value. (a) In condition that the thrust of said pressure pulse wave sensor is maintained by said optimal thrust with said optimal ss force-control means, and said living body's presumed blood-pressure value is determined by said presumed blood-

;sure value decision means A press condition gap judging means by which the press condition over said artery of the ;e wave sensor judges the gap from the optimal press condition, (b) when the gap from said optimal press condition ıe thrust to said artery of said pulse wave sensor is judged by the press condition gap judging means It is in uding an optimal thrust amendment means to amend the optimal thrust of said pressure pulse wave sensor currently ;sed by said press equipment so that the gap from the optimal press condition may decrease.

)06]

ect of the Invention] If it does in this way, when the gap from said optimal press condition of the thrust to said artery aid pulse wave sensor is judged [be / it / under / by presumed blood pressure / continuous blood-pressure monitor / ing] by the press condition gap judging means, the optimal thrust of said pressure pulse wave sensor currently ;sed by said press equipment will be amended by the optimal thrust amendment means so that the gap from the .mal press condition may decrease. Even if the thrust for following, for example, the concordance deformation of a ;s part or the depression by slack and pressure pulse wave sensor of the wearing belt of a pressure pulse wave sensor urring [be / it / under / continuation blood-pressure monitor / setting], and considering as the optimal press dition is insufficient Since increment amendment of the thrust of the pressure pulse wave sensor pressed by press ipment is carried out from the optimal thrust currently maintained till then and the gap from the optimal press dition decreases with an optimal thrust amendment means, blood-pressure monitor precision is maintained.

)07]

her modes of invention] Suitably here said presumed blood-pressure value decision means It sets to comparatively thrust lower than the optimal thrust among two or more pressure sensing elements arranged in the press side of said ;sure pulse wave sensor. The magnitude of the pressure pulse wave which determined the center position pressure sing element that the component which outputs the maximum pulse wave amplitude will take the lead in a pressure ıponent, and was detected by the center position pressure sensing element, Based on the relation with the criteria ɔd-pressure-measurement value measured using the cuff called for beforehand, said living body's presumed blood- ;sure value is serially determined from the magnitude of the pressure pulse wave outputted from the center position ;sure sensing element.

)08] Suitably moreover, said press condition gap judging means In the condition that the thrust of said pressure pulse ve sensor is maintained by said optimal thrust with said optimal press force-control means, and said living body's sumed blood-pressure value is determined by said presumed blood-pressure value decision means When the pressure ue beforehand set as amplitude within the limits of the pressure value detected by the center position pressure sensing nent of said pressure pulse wave sensor is detected by the center position pressure sensing element It asks for the ssure-distribution curve in the press side which is and shows the relation of the pressure value and location of a ssure sensing element. a 2-dimensional coordinate with the location shaft in which the location of the pressure shaft vhich the pressure value is shown, and the above-mentioned pressure sensing element is shown based on the pressure ue detected by each pressure sensing element -- Based on a difference, the pressure-distribution curve, i.e., the eria pressure-distribution curve, for which it asked at the time of the pressure-distribution curve and said optimal ıst decision, or response-related decision, the gap from the optimal press condition of said pressure sensor is judged.

)09] Moreover, suitably, said press condition gap judging means judges with the optimal press condition of a pressure se wave sensor being maintained, when it is decision-criterion within the limits to which the gap of the both ends of a ual pressure-distribution curve was beforehand set to the both ends of said criteria pressure-distribution curve. wever, to the both ends of said criteria pressure-distribution curve, it judges with the press condition that it was actual en both the both ends of a actual pressure-distribution curve are high having shifted in the increment direction in ıst from the optimal press condition in said press condition gap judging means, and said optimal thrust amendment ans decreases the thrust of said pressure pulse wave sensor to press equipment. Moreover, it judges with the press ıdition that it was actual when both the both ends of a actual pressure-distribution curve are low having shifted in the ust reduction direction from the optimal press condition in said press condition gap judging means, and said optimal ust amendment means makes the thrust of said pressure pulse wave sensor increase to press equipment to the both ls of said criteria pressure-distribution curve.

)10]

:ample] Hereafter, one example of this invention is explained to a detail based on a drawing.

)11] Drawing 1 is drawing showing the example of 1 configuration of the thrust amendment mold continuation blood- :ssure supervisory equipment of this invention, for example, it is used in order to supervise under an operation, the ıdition of the patient after an operation, the living body under exercise stress test, etc. In drawing, 10 is a cuff which ; rubber bag-making in the band-like bag made of cloth, for example, it is equipped with it in the condition of having :n wound around a patient's overarm section 12. The pressure sensor 14, the exhaust air control valve 16, and the air

np 18 are connected to the cuff 10 through piping 20, respectively. The exhaust air control valve 16 is constituted so t it may be switched to three conditions, the pressure supply condition of permitting supply of the pressure into a cuff the **** exhaust-gas-pressure condition which carries out exhaust gas pressure of the inside of a cuff 10 gradually, l the rapid exhaust-gas-pressure condition which carries out exhaust gas pressure of the inside of a cuff 10 quickly.
12] A pressure sensor 14 supplies the pressure signal SP with which the pressure in a cuff 10 is detected and the ssure is expressed to the static pressure discriminator 22 and the pulse wave discriminator 24, respectively. The static ssure discriminator 22 is equipped with the low pass filter, discriminates from the cuff pressure signal SK showing steady pressure contained in the pressure signal SP, and supplies the cuff pressure signal SK to an arithmetic uence unit 28 through A/D converter 26. It is the pulse wave signal SM 1 which the pulse wave discriminator 24 is ıipped with the band pass filter, and is the oscillating component of the pressure signal SP. It discriminates and is the se wave signal SM 1. An arithmetic sequence unit 28 is supplied through A/D converter 30. This pulse wave signal [1 The cuff pulse wave to express is a pressure oscillatory wave which occurs from the brachial artery which is not strated synchronizing with a patient's heartbeat, and is transmitted to a cuff 10, and the above-mentioned pulse wave criminator 24 is functioning as a cuff pulse wave detection means.
13] The above-mentioned arithmetic sequence unit 28 consists of so-called microcomputers equipped with CPU29, M31, RAM33, the I/O Port that is not illustrated, and CPU29 controls the exhaust air control valve 16 and an air np 18 by performing signal processing through the actuation circuit which does not output and illustrate a driving nal from an I/O Port, using the memory storage function of RAM33 for ROM31 according to the program morized beforehand. On the occasion of the blood pressure measurement using a cuff 10, after carrying out rapid ssure up of the pressure in a cuff 10, for example to the predetermined target preassure force, **** pressure lowering arried out at the rate of 3 mmHg/sec extent. Pulse wave signal SM 1 serially extracted in the **** pressure-lowering cess Based on change of the pulse wave to express, blood-pressure values (criteria blood-pressure value), such as a hest-blood-pressure value and a lowest-blood-pressure value, are determined by the oscillometric method, and the ermined blood-pressure value is displayed on a drop 32.
14] The pressure pulse wave detection probe 34 is equipped with the screw-thread shaft 41 by which revolution uation is carried out by the motor which was screwed in that sensor housing 36, and was formed in the actuator 39 of ase 37, and which is not illustrated in order to move the case 37 where the sensor housing 36 which constitutes the pe of a container is held, and this sensor housing 36 crosswise [of a radial artery 56], as shown in drawing 2 in ail. The wearing band 40 is attached in the above-mentioned case 37, and it is attached in a wrist, the side, for mple, the left-hand side, where the cuff 10 is not wound with the wearing band 40 in the condition that the opening ge of the sensor housing 36 which constitutes the shape of an above-mentioned container counters the body surface of the body, 42 removable. It is prepared in the interior of the above-mentioned sensor housing 36 through diaphram that the pressure pulse wave sensor 46 can be displaced relatively and possible [the projection from the opening ge of the sensor housing 36], and the pressure room 48 is formed in it of these sensors housing 36 and diaphram 44 de. In this pressure room 48, pressure air is supplied through a pressure regulating valve 52 from an air pump 50, l, thereby, the pressure pulse wave sensor 46 is pressed by said body surface 38 by the thrust according to the ssure in the pressure room 48. In addition, at this example, the thrust of the pressure pulse wave sensor 46 is shown the pressure in the pressure room 48 (unit: mmHg).
15] The above-mentioned sensor housing 36 and diaphram 44 constitute the press equipment 62 which presses the ssure pulse wave sensor 46 toward a radial artery 56, and the above-mentioned screw-thread shaft 41 and the motor ich is not illustrated constitute, the press repositioning equipment 64, i.e., the crosswise migration equipment, which noved crosswise [of the radial artery 56] and changes the press location where the pressure pulse wave sensor 46 is ssed.
16] The above-mentioned pressure pulse wave sensor 46 for example In the cross direction of a radial artery 56, i.e., migration direction of the pressure pulse wave sensor 46 parallel to the screw-thread shaft 41, many semi-conductor ssure sensitive devices (not shown) are arranged at intervals of [fixed] about 0.2mm, and are constituted by the ss side 54 which consists of the semiconductor chip which consists of single crystal silicon etc. Pressure pulse wave nal SM 2 with which it detects, the pressure oscillatory wave, i.e., the pressure pulse wave, which occurs from a lial artery 56 and is transmitted to a body surface 38 by being pressed on the radial artery 56 of the body surface 38 of rist 42, and the pressure pulse wave is expressed An arithmetic sequence unit 28 is supplied through A/D converter . It is the pressure pulse wave SM 2 by which drawing 3 was detected by the pressure pulse wave sensor 46. An mple is shown.
17] CPU29 of an arithmetic sequence unit 28 performs signal processing, using the memory storage function of M33 for ROM31 according to the program memorized beforehand, outputs a driving signal through the actuation

:uit which is not illustrated to an air pump 50 and a pressure regulating valve 52, and adjusts the pressure in the ssure room 48. An arithmetic sequence unit 28 determines the optimal thrust PHDPO of the pressure pulse wave sor 46 for making some blood vessel walls of a radial artery 56 into abbreviation flatness on the occasion of a ıtinuation blood-pressure monitor based on the pressure pulse wave serially obtained in the **** pressure variation cess in the pressure room 48, and controls a pressure regulating valve 52 to maintain the optimal thrust PHDPO. reover, highest-blood-pressure value BPSYS by which the arithmetic sequence unit 28 was measured using the cuff And lowest-blood-pressure value BPDIA It is based on the peak price PMmax and the minimum value PMmin of the ssure pulse wave detected by the center position pressure sensing element (active element) located right above the ial artery 56 of the semi-conductor pressure sensitive devices of the pressure pulse wave sensor 46 where the above-ntioned optimal thrust PHDPO is maintained. It asks for the response relation between the blood-pressure values BP l magnitude PM (absolute value) of a pressure pulse wave which were measured. From this response relation By the ssure pulse wave sensor 46 Based on magnitude PM (top peak value) PMmax, i.e., (mmHg), the peak price, and the ıimum value (bottom peak value) PMmin of a pressure pulse wave which are detected serially, the highest-blood-ssure value MBPSYS and the lowest-blood-pressure value MBPDIA (a presumed blood-pressure value, i.e., a nitor blood-pressure value) are determined serially. It sets to a drop 32 and is the determined highest-blood-pressure ue MBPSYS. And lowest-blood-pressure value MBPDIA A digital readout is carried out for every beat, and the ve which shows the presumed blood-pressure value MBP is displayed continuously.

·18] The relation corresponding to the above is shown in drawing 4 , and is expressed by the formula 1. In this mula 1, the constant A indicates an inclination to be, and B are constants which show an intercept.

·19]

ıuation 1] MBP=A-PM+B [0020] Drawing 5 is a functional block diagram explaining the important section of the ıtrol function of the arithmetic sequence unit 28 in the press amendment mold continuation blood-pressure ıervisory equipment constituted as mentioned above. In drawing, the compression pressure force of the cuff 10 ınged by the cuff pressure control means 68 is detected by the pressure sensor 14 on the occasion of blood pressure asurement. The blood-pressure value measurement means 70 measures a living body's highest-blood-pressure value SYS, the mean-blood-pressure value BPMEAN, and the lowest-blood-pressure value BPDIA (criteria blood-pressure ue) according to an oscillometric method or a Korotkoff-sounds method based on change of the pulse synchronizing nal obtained in the process in which the compression pressure force by the cuff 10 is gradually changed at the rate of 3 mmHg/sec extent, for example, the pulse wave amplitude, and Korotkoff sounds.

·21] The related decision means 72 is magnitude PM of the pressure pulse wave detected by the center position ssure sensing element (active element) located right above a radial artery 56 among two or more pressure sensing ments arranged in the press side 54 of the pressure pulse wave sensor 46. The response relation between the blood-ssure values BP measured by the blood-pressure value measurement means 70 is beforehand determined, as shown in wing 4 . The presumed blood-pressure value decision means 74 determines continuously a living body's presumed od-pressure value MBP from the response relation based on the magnitude of the pressure pulse wave detected by above-mentioned active element among two or more pressure sensing elements arranged in the press side 54 of the ssure pulse wave sensor 46.

·22] What detects the maximum amplitude of the pressure sensing elements arranged in the press sides 54, such as the .e of first-time wearing, the optimal press position control means 76 When are located in the edge of the array ations and the predetermined renewal conditions of a press location are satisfied It is the comparatively small 1st ss value P1 smaller enough than the below-mentioned optimal thrust PHDPO set up beforehand about the pressure se wave sensor 46 by press equipment 62. It is made to press. It judges whether what shows the maximum pulse ve amplitude in the condition among each pressure sensing element of the pressure pulse wave sensor 46 is located in abbreviation center section beforehand set up in the array direction of the pressure sensing element. When the :ision is denied (i.e., when the component which shows the maximum pulse wave amplitude is not located in the ›reviation center section of the pressure sensing element), while making the pressure pulse wave sensor 46 once late from a body surface 38, after moving press equipment 62 and the pressure pulse wave sensor 46 with crosswise gration equipment 64, above-mentioned actuation and decision are performed again. However, the thing the above-ntioned decision indicates the maximum pulse wave amplitude to be among each pressure sensing element of the irmation **** case 46, i.e., a pressure pulse wave sensor When located in the abbreviation center section beforehand up in the array direction of the pressure sensing element Since it is in the condition that the optimal press location s obtained, while setting up the pressure sensing element which outputs the above-mentioned maximum pulse wave plitude as a mid-gear pressure sensing element (active element) and memorizing it, actuation of the optimal press ce-control means 80 is permitted.

)23] The optimal press force-control means 80 changes continuously the thrust of the pressure pulse wave sensor 46 ated by the optimal press location with the optimal press position control means 76, determines the optimal thrust DPO based on the pressure pulse wave obtained by the process, and makes the pressure pulse wave sensor 46 press the optimal thrust PHDPO. As the optimal thrust PHDPO here For example, the press value of centering on ximum of pulse wave amplitude obtained from active element of pressure pulse wave sensor 46 like above-ntioned increment fault in thrust continuation as shown in drawing 6 predetermined within the limits, And/or, ssure pulse wave signal SM 2 acquired by the thrust process It is the press value of centering on center of flat part med in curve (broken line of drawing 6) which connects the bottom peak value SMmin in topographic contour plot wing bottom peak value SMmin and thrust of pressure pulse wave sensor 46 predetermined within the limits.
)24] The criteria pressure-distribution curvilinear storage means 82 is set at the time of the above-mentioned optimal ust PHDPO decision. For example, the pressure value beforehand set up so that the thrust detected by the active ment might fully serve as the inside from the present living body's blood-pressure range of fluctuation (%) at the plitude within the limits, For example, presumed lowest-blood-pressure value MBPDIA when it becomes a pressure iivalent to 90% of the maximum pulse wave amplitude An axis of ordinate is set as the thrust (pressure signal SM 2) ected by each pressure sensing element when becoming a pressure equivalent to the value which applied 90% of se pressure. The pressure-distribution curve which sets an axis of abscissa as the location of the above-mentioned ssure sensing element is memorized as a criteria pressure-distribution curve (reference pressure tonogram).
)25] As for the press condition gap judging means 84, the press location of the pressure pulse wave sensor 46 is intained by said optimal press position control means 76 in said optimal press location. In the condition that the ust of the pressure pulse wave sensor 46 is maintained by the optimal thrust PHDPO by said optimal press force-trol stage 80, and said living body's presumed blood-pressure value is serially determined by said presumed blood-ssure value decision means 74 The gap with the actual pressure-distribution curve of said pressure pulse wave sensor l the criteria pressure-distribution curve at the time of the press in the optimal thrust PHDPO memorized in said eria pressure-distribution curvilinear storage means 82 is judged. Namely, the above-mentioned press condition gap ging means 84 [when the thrust detected by the active element became the same as the thrust at the time of said eria pressure-distribution curvilinear decision] It asks for the actual pressure-distribution curve created based on the ssure pulse wave detected by each pressure sensing element, respectively. A gap of the thrust of the press side 54 is ged based on the gap with the both ends of the criteria pressure-distribution curve memorized at the time of setting of the optimal thrust PHDPO by the both ends of the pressure-distribution curve, and said criteria pressure-tribution curvilinear storage means 82.
)26] For example, as shown in drawing 7 , when the gap, i.e., a pressure differential, between the both ends of a eria pressure-distribution curve (continuous line) and the both ends of said pressure-distribution curve (broken line) lecision-criterion within the limits (for example, **5mmHg) set up beforehand, there is no gap with a press condition en said criteria pressure-distribution curve is determined, and the present press condition, namely, it judges the ve-mentioned press condition gap judging means 84 that thrust is suitable. In addition, drawing 7 is drawing which ressed the pressure differential of both ends characteristic only paying attention to the both ends of a pressure-tribution curve (the same is said of drawing 8 , drawing 9 , and drawing 10). Moreover, as shown in drawing 8 , a of the both ends of a criteria pressure-distribution curve (continuous line) and the both ends of said pressure-tribution curve (broken line) crosses the range set up beforehand, and when the both ends of said pressure-tribution curve are pressures higher than both the both ends of a criteria pressure-distribution curve, it is judged that thrust by press equipment 62 shifted in the increment direction in thrust from the optimal press condition. Moreover, shown in drawing 9 , a gap of the both ends of a criteria pressure-distribution curve (continuous line) and the both ls of said pressure-distribution curve (broken line) crosses the range set up beforehand, and when the both ends of d pressure-distribution curve are pressures lower than both the both ends of a criteria pressure-distribution curve, it is ged that the thrust by press equipment 62 shifted in the thrust reduction direction from the optimal press condition. reover, as shown in drawing 10 , a gap of the both ends of a criteria pressure-distribution curve (continuous line) and both ends of said pressure-distribution curve (broken line) crosses the range set up beforehand, it is a pressure with piece edge of said pressure-distribution curve higher than the edge of the same side of a criteria pressure-distribution ve, and when it is a pressure with the other-end section lower than the edge of the same side of a criteria pressure-tribution curve, in mere thrust amendment, it is judged that it is uncancelable.
)27] When it is judged that the gap of a press condition produced the optimal thrust amendment means 86 with said ss condition gap judging means 84, the thrust of the press equipment 62 which is pressing the pressure pulse wave sor 46 according to extent of a gap of a press condition is amended so that the difference of the both ends of said eria pressure-distribution curve and the both ends of a actual pressure-distribution curve may be canceled, namely, so

t the gap from the optimal press condition may decrease. for example, as shown in drawing 8 , when the thrust by ss equipment 62 shifts in the increment direction in thrust from the optimal press condition As the thrust of the press ıipment 62 which is pressing the pressure pulse wave sensor 46 according to extent of a gap is weakened and it is ›wn in drawing 9 When the thrust by press equipment 62 shifts in the thrust reduction direction from the optimal ss condition As the thrust of the press equipment 62 which is pressing the pressure pulse wave sensor 46 according to ent of a gap is strengthened and it is shown in drawing 10 In mere thrust amendment, when the gap cannot be solved roughly, the thrust of the press equipment 62 which is pressing the pressure pulse wave sensor 46 is amended so that gap with the both ends of a criteria pressure-distribution curve and the both ends of a actual pressure-distribution ve may serve as min.

28] Drawing 11 and drawing 12 are the flow charts explaining the important section of control actuation of the ›ve-mentioned arithmetic sequence unit 28, drawing 11 shows a main routine, and drawing 12 shows the thrust endment control routine which amends the thrust of the pressure pulse wave sensor 46, while performing decision uation of presumed blood pressure continuously.

29] At step S1 (a step is skipped hereafter.) of drawing 11 , it is judged whether the elapsed time after response ıtion is updated by whether it is activation of the first time of S1 and last time exceeded the calibration period set up ıbout ten minutes thru/or about dozens of minutes beforehand. Usually, since the decision of S1 is denied, it is judged ether it changed into the condition that what detects the maximum amplitude of the pressure sensing elements ınged [whether in S2, the predetermined renewal conditions of a press location (APS starting conditions) were :sfied and] in the press side 54 of the pressure pulse wave sensor 46 is located in the edge of the array locations.

30] If the press location of the pressure pulse wave sensor 46 to a radial artery 56 is a normal range, since decision of above S2 will be denied [whether the body motion to which the press conditions of the pressure pulse wave sensor are changed in S3, so that the response relation of drawing 4 is changed was detected, and] Or it is judged whether ed on whether it changed substantially to the blood-pressure value BP by which the monitor blood-pressure value 3P was measured using the last cuff 10, the starting conditions for updating the response relation for a blood-pressure nitor or optimal thrust decision starting conditions (HDP starting conditions) were satisfied.

31] It is the pressure pulse wave signal SM 2 whether since decision of the above S3 was denied when it was thought t there is no change in the press conditions of the pressure pulse wave sensor 46, and the response relation of drawing ; not changing, one pressure pulse wave occurred in S8. It is based and judged. When this decision of S8 is denied, it nade to stand by by performing S1, S2, S3, and S8 repeatedly. However, if one pressure pulse wave occurs and :ision of S8 is affirmed, it will set to S9 corresponding to said presumed blood-pressure value decision means 74. ssure pulse wave signal SM 2 from the active element of the pressure pulse wave sensor 46 currently pressed by the imal thrust PHDPO from -- The peak price PMmax and the minimum value PMmin of the wave motion are ermined, and it is based on the peak price PMmax and the minimum value PMmin of the pressure pulse wave from response relation of drawing 4 , and is the presumed highest-blood-pressure value MBPSYS. And presumed lowest-od-pressure value MBPDIA It is determined. while being serially displayed on a drop 32 for every beat -- the ponse relation of drawing 4 , and pressure pulse wave signal SM 2 from -- the continuous wave form of the ermined presumed blood-pressure value is displayed on a drop 32.

32] Since said decision of S1 will be affirmed if the elapsed time after response relation is determined as last time, ile the above step is performed repeatedly exceeds the calibration period set up beforehand, after blood pressure asurement using a cuff 10 is performed in S6, response relation is updated in S7 and less than [the / account Sof :k to front 8] is performed. namely, by S6 corresponding to said blood-pressure value measurement means 70, first :er the exhaust air control valve's 16 operating a switch and an air pump 18 in the pressure supply condition and rying out pressure up of the pressure in a cuff 10 to the target preassure force (for example, 180mmHg(s)) higher n the highest-blood-pressure value a patient is expected to be, By making it descend at the **** pressure-lowering : to which the air pump 18 was stopped, and the exhaust air control valve 16 was switched to the **** exhaust-gas-ssure condition, and the pressure in a cuff 10 was beforehand set by 3 mmHg/sec extent Pulse wave signal SM 1 ially acquired in this **** pressure-lowering process It is based on change of the amplitude of the pressure pulse ve to express. While the highest-blood-pressure value BPSYS, the mean-blood-pressure value BPMEAN, and the ›est-blood-pressure value BPDIA (criteria blood-pressure value) are measured according to the blood-pressure value :ision algorithm of an oscillograph metric method known well, a pulse rate etc. is determined based on pulse wave cing. And while the blood-pressure value, pulse rate, etc. which were measured are displayed on a drop 32, the ıaust air control valve 16 is switched to a rapid exhaust-gas-pressure condition, and exhaust gas pressure of the inside ı cuff 10 is carried out quickly.

33] Next, blood-pressure values BPSYS and BPDIA by the cuff 10 measured in S7 corresponding to said related

ision means 72 in the magnitude (an absolute value, i.e., magnitude of the pressure pulse wave signal SM 2) of the ssure pulse wave from the active element of the pressure pulse wave sensor 46, and the above S6 The response ition of a between is called for and updated. Namely, highest-blood-pressure value BPSYS measured by the cuff 10 he peak price PMmax of these pressure pulse waves and the minimum value PMmin, and S6 while one beat of ssure pulse waves from the active element of the pressure pulse wave sensor 46 was read and the peak price PMmax l the minimum value PMmin of the pressure pulse wave were determined And lowest-blood-pressure value BPDIA It ased and the response relation between the magnitude of a pressure pulse wave and the blood-pressure values which shown in drawing 4 is determined.

34] Since said decision of S2 is affirmed when the press location to the radial artery 56 of the pressure pulse wave sors 46, such as the time of first-time wearing, shifts and predetermined press repositioning conditions (APS starting ditions) are satisfied, the APS control routine of S4 corresponding to said optimal press position control means 76 is formed. It is the pressure pulse wave signal SM 2 by which this APS control routine was detected by each pressure sing element of the pressure pulse wave sensor 46, respectively. The component which detects the maximum plitude of an amplitude distribution curve While the optimal press location which turns into an abbreviation center ition of a pressure sensing element is determined The component which detects the maximum amplitude at that time et up as a center position pressure sensing element, i.e., an active element. After the pressure pulse wave sensor 46 is itioned in the optimal press location, in the HDP control routine of S5 corresponding to said optimal press force- trol means 80, in and the process in which the thrust of the pressure pulse wave sensor 46 is heightened continuously ust in case the amplitude of the pressure pulse wave detected by the active element located right above a radial artery serves as max is determined as optimal thrust PHDPO, and is updated, and the thrust of the pressure pulse wave sor 46 is held by the optimal thrust PHDPO. And where the pressure pulse wave sensor 46 is pressed by the optimal ust PHDPO, less than [future / S6] is performed. Moreover, in S2, it is judged that the press location of the pressure se wave sensor 46 is suitable, namely, decision of S2 is denied, and when said decision of S3 is affirmed in the dition that the blood-pressure monitor is performed continuously, below the HDP control routine of the above S5 is formed.

35] Under the actuation by which the thrust of the pressure pulse wave sensor 46 is held by the optimal thrust DPO, and a living body's blood-pressure value is hereafter supervised continuously in the above-mentioned main tine, Namely, it sets at the period when S1, S2, S3, S8, and S9 are performed repeatedly. When a gap occurs in the ust of the pressure pulse wave sensor 46, extent of a gap of the thrust of the pressure pulse wave sensor 46 is judged, l the thrust amendment control routine amended so that thrust may become the optimal is explained using drawing .

36] a ****** [that response-related updating (cuff calibration) shown in drawing 4 in S7 corresponding to the ted decision means 72 was performed in SS1 of drawing 12] -- or in S5 corresponding to the optimal press force- trol means 80, it is judged whether the optimal thrust PHDPO of the pressure pulse wave sensor 46 was updated. en decision of this SS1 is denied, the thrust of the pressure pulse wave sensor 46 is held by that optimal thrust DPO, and SS3 or subsequent ones is performed. However, when decision of this SS1 is affirmed, in SS2 responding to said criteria pressure-distribution curvilinear storage means 82, a pressure-distribution curve when a ssure-distribution curve or the optimal thrust PHDPO when response relation is updated is updated is memorized as a eria pressure-distribution curve. This criteria pressure-distribution curve serves as criteria which judge a gap of ust.

37] subsequently, in SS3, in order to remove a variation, the averaging operator of the pressure-distribution curve ich was alike till then and was obtained for every beat the gap judging of the last thrust or later or after renewal of ponse relation is performed, and the average pressure-distribution curve equalized by the predetermined within a time is obtained. And decision-criterion value NM to which the content "N" of the number counter CN of beats which ries out counting of the number of beats was beforehand set in SS4 It is judged whether it became the above. This ision-criterion value NM It corresponds to a gap judging period and the value equivalent to several beats thru/or ut ten beats is set up. In this SS4, it may be judged whether the decision-criterion time amount to which the elapsed e from the last gap judging or later was set beforehand was reached.

38] Since decision of the above SS 4 was denied, after "1" is added to the content "N" of the above-mentioned nber counter CN of beats in SS5 at the beginning, said three or less SS is performed again. And if decision of the ve SS 4 is affirmed while the above [SS / SS and / 5] 3 is performed repeatedly, in SS6 corresponding to said press dition gap judging means 84, a gap of the both ends of the average pressure-distribution curve to the both ends of l criteria pressure-distribution curve will be judged.

39] Here, the judgment approach of a gap of a press condition is judged by gap of the both ends of said average

ssure-distribution curve to the both ends of the criteria pressure-distribution curve memorized when response relation s updated, or when the optimal thrust PHDPO was updated last time. For example, as shown in drawing 7 , when a) of the both ends of a criteria pressure-distribution curve (continuous line) and the both ends of said average ssure-distribution curve (broken line) is decision-criterion within the limits (for example, **5mmHg) set up orehand, thrust is suitable, i.e., it judges that there is no gap with thrust when said criteria pressure-distribution curve letermined, and the present press condition, and decision of SS6 is denied. And in continuing SS7, the thrust of the ssure pulse wave sensor 46 is held at the thrust till then.

040] However, according to extent of a gap judged in SS6, when decision of SS6 is affirmed, in SS8 corresponding to optimal thrust amendment means 86, the thrust of press equipment 62 is amended so that the gap from the optimal ss condition may decrease. For example, it responds to extent of the gap so that it may judge that the thrust by press ıipment 62 shifted in the increment direction in thrust from the optimal press condition and the difference of the both ls of a criteria pressure-distribution curve and the both ends of an average pressure-distribution curve may be ıceled, when the both ends of said average pressure-distribution curve (broken line) are pressures higher than both the h ends of a criteria pressure-distribution curve (continuous line), as shown in drawing 8 , and the thrust of press ıipment 62 is weak **. Moreover, it responds to extent of the gap so that it may be judged that the thrust by press ıipment 62 shifted in the thrust reduction direction from the optimal press condition and the difference of the both ls of a criteria pressure-distribution curve and the both ends of an average pressure-distribution curve may be ıceled, when the both ends of said average pressure-distribution curve (broken line) are pressures lower than both the h ends of a criteria pressure-distribution curve (continuous line), as shown in drawing 9 , and the thrust of press ıipment 62 is stronger **. Moreover, as shown in drawing 10 , after the press location of the press side 54 of the ssure pulse wave sensor 46 shifted and said active element has shifted from right above a radial artery 56, the piece ge of said average pressure-distribution curve (broken line) is a pressure higher than the edge of the same side of a eria pressure-distribution curve (continuous line), and the other-end section serves as a pressure lower than the edge the same side of a criteria pressure-distribution curve. In this case, the thrust of press equipment 62 is amended so t a gap of both ends may serve as min. And in continuing SS12, the pressure-distribution curve obtained at the time amendment of thrust is updated as a criteria pressure-distribution curve.

041] As mentioned above, according to this example, when a gap of the thrust to the wrist 42 of the pressure pulse ve sensor 46 is judged by the press condition gap judging means 84 (SS6), the optimal thrust amendment means 86 38) amends [be / it / under / using presumed blood pressure / continuous blood-pressure monitor / setting] a gap of thrust of the pressure pulse wave sensor 46 so that the gap from the optimal press condition may decrease. For this son, since the thrust to the wrist 42 of the pressure pulse wave sensor 46 is optimized without starting optimal press alization actuation and optimal thrust decision actuation, a blood-pressure monitor is continued promptly.

042] According to this example, moreover, the press condition gap judging means 84 (SS6) In the condition that a ing body's presumed blood-pressure value is continuously determined by the presumed blood-pressure value decision ans 74 (S9) Based on the gap with the average of the pressure-distribution curve serially obtained from the pressure se wave sensor 46, i.e., the both ends of an average pressure-distribution curve, and the both ends of the criteria ssure-distribution curve obtained at the time of the renewal of response relation, or the last thrust amendment, a gap the press condition of the press side is judged. With [extent of a gap] a reference value [less than], the judgment of ap of this press condition holds thrust. Extent of a gap exceeds a reference value, and when it is a pressure with both both ends of the above-mentioned average pressure-distribution curve higher than the both ends of the above-ntioned criteria pressure-distribution curve It is what weakens the thrust of press equipment with the optimal thrust endment means 86 (SS8) in the direction where the gap from the optimal press condition decreases. When it is a ssure with both the both ends of the above-mentioned average pressure-distribution curve lower than the both ends of above-mentioned criteria pressure-distribution curve It is what strengthens the thrust of press equipment with the imal thrust amendment means 86 (SS8) in the direction where the gap from the optimal press condition decreases. ıen the piece edge of the above-mentioned average pressure-distribution curve is a pressure higher than the edge of same side of a criteria pressure-distribution curve and the other-end section is a pressure lower than the edge of the ne side of a criteria pressure-distribution curve, the thrust of press equipment 62 is amended so that a gap of both ls may serve as min. For this reason, there are accuracy and an advantage which can judge a gap of the press ıdition of the pressure pulse wave sensor 46 easily comparatively.

043] According to this example, moreover, a criteria pressure-distribution curve and a actual pressure-distribution ve Since it is decided from the detection pressure value of each pressure sensing element that it will be the flash en the pressure detected by the center position pressure sensing element at the time of the optimal thrust decision ame the pressure value determined in the range of fluctuation (pulse wave amplitude) Since a pressure-distribution

ve is not influenced by a living body's blood-pressure fluctuation, there is an advantage to which the precision of endment of the optimal thrust is raised.

44] As mentioned above, although one example of this invention was explained based on the drawing, this invention pplied also in other modes.

45] For example, although SS2, SS4, and SS5 for computing an average pressure-distribution curve were prepared in example of above-mentioned drawing 12 , it does not necessarily need to be prepared.

46] Moreover, in the above-mentioned example, in order that an overarm might be equipped with a cuff 10 and the ssure pulse wave sensor 46 might detect the pressure pulse wave of a radial artery, the wrist was equipped, but the de peg may be equipped, in order that a cuff 10 may be wound around a femoral region and the pressure pulse wave sor 46 may detect the pressure pulse wave of the arteria dorsalis pedis of the near leg around which the cuff 10 is not und.

47] Moreover, in the above-mentioned example, when the thrust of the pressure pulse wave sensor 46 is changed by optimal thrust amendment means 86 and presumed blood pressure changes a predetermined value or more than a determined rate, S6 less or equal corresponding to said blood-pressure value decision means 70 may be made to ry out automatically.

48] Moreover, although the criteria pressure-distribution curve was computed using the thrust detected by each ssure sensing element when the thrust detected by the active element turns into a pressure equivalent to 90% of the ximum pulse wave amplitude in the above-mentioned example The pressure detected from the active element at the e of reference pressure distribution curve calculation may not be restricted to the pressure equivalent to 90% of the ximum pulse wave amplitude, but may be 80% or 20%. Even if there is fluctuation of a living body's blood pressure, at is necessary is just the pressure detected by the active element. Namely, what is necessary is just not to be a value r the value or the minimum value PMmin near a peak price PMmax of a pressure pulse wave of an active element at time of a reference pressure distribution curve being computed.

49] In addition, in the range in which this invention does not deviate from the main point, modification may be led variously.

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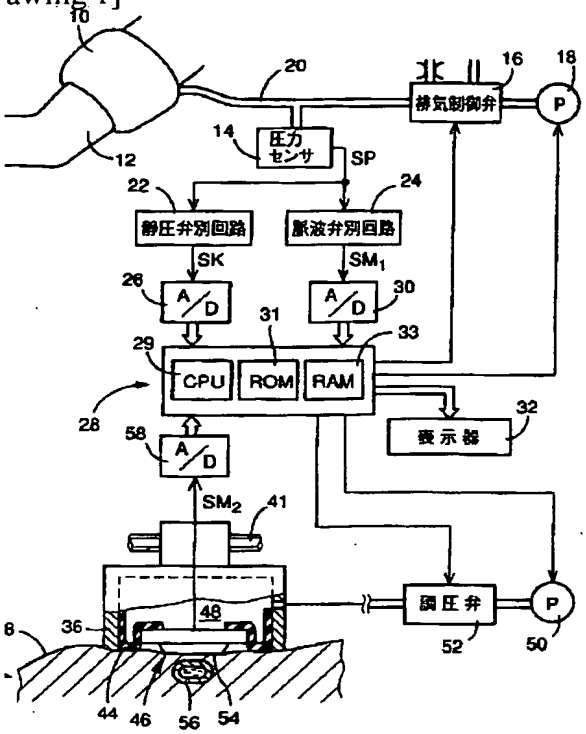
OTICES *

an Patent Office is not responsible for any
ages caused by the use of this translation.

his document has been translated by computer. So the translation may not reflect the original precisely.
*** shows the word which can not be translated.
1 the drawings, any words are not translated.

AWINGS

awing 1]



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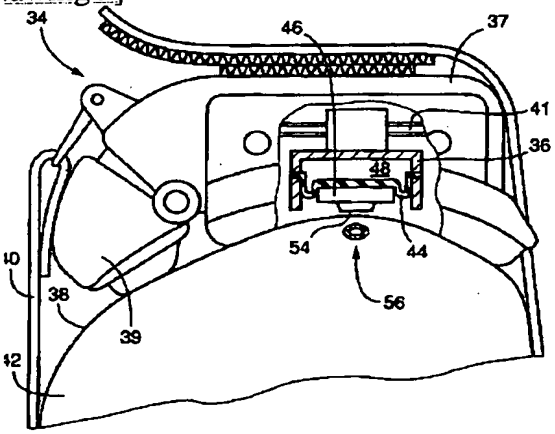

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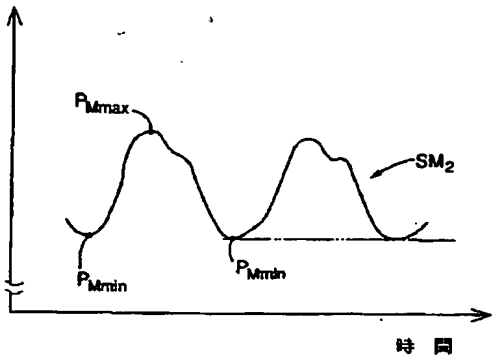

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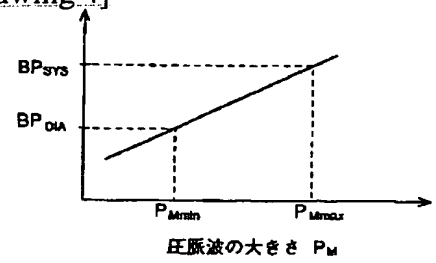

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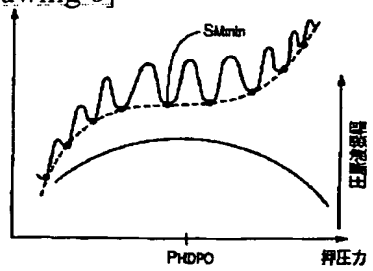

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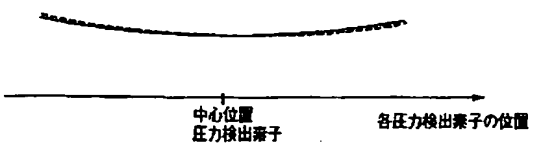

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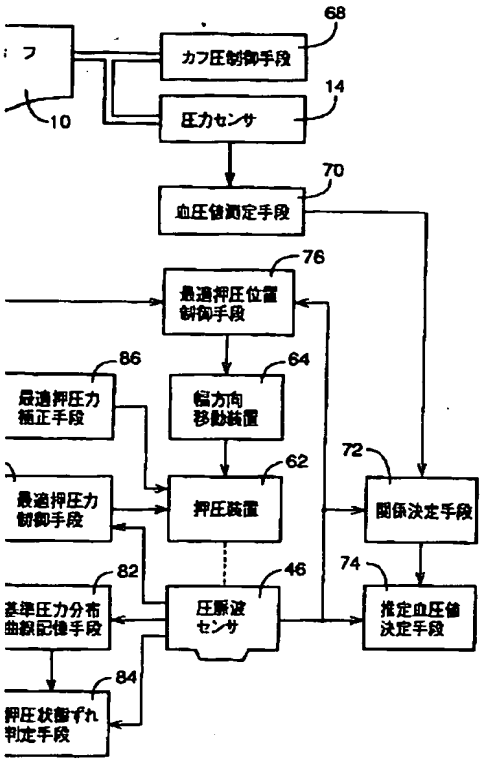

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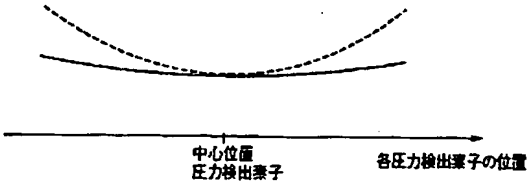

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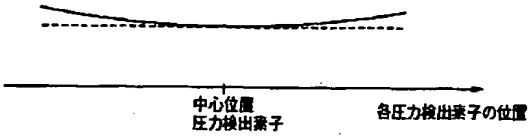

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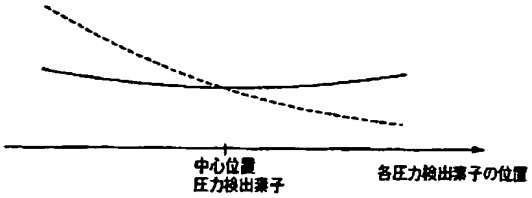

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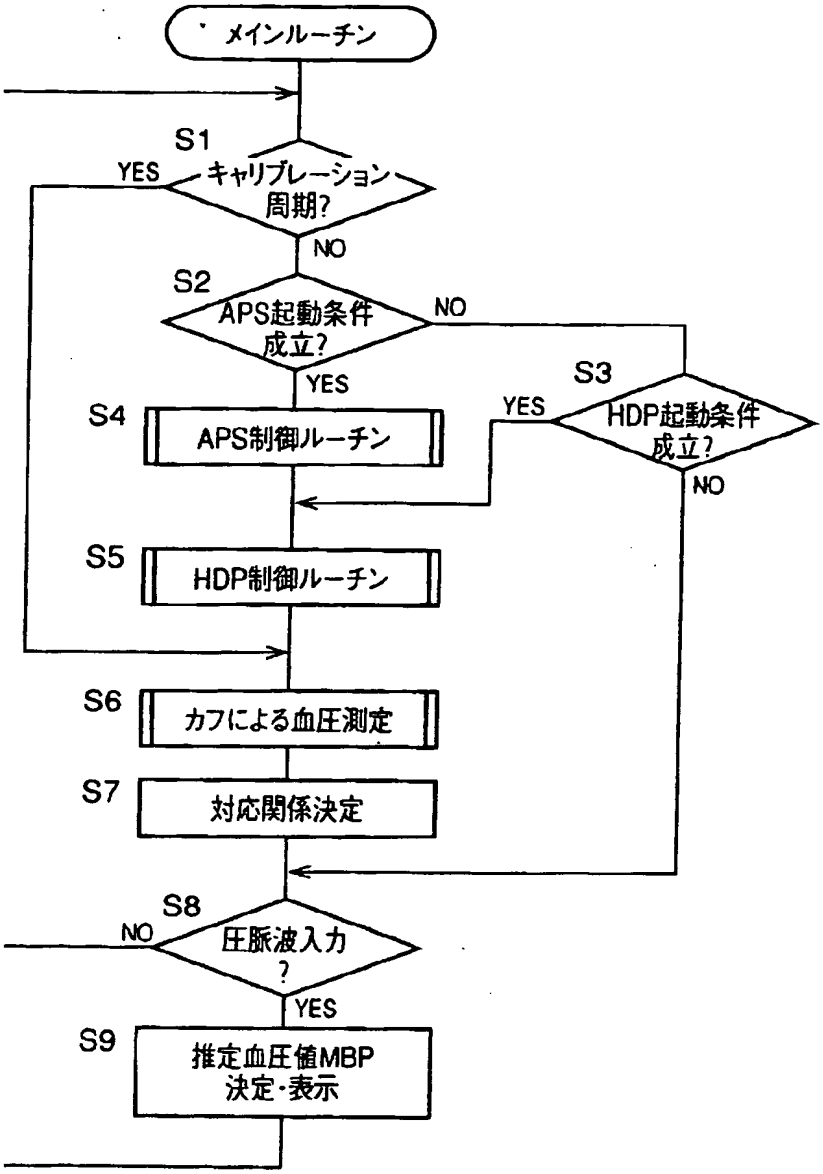
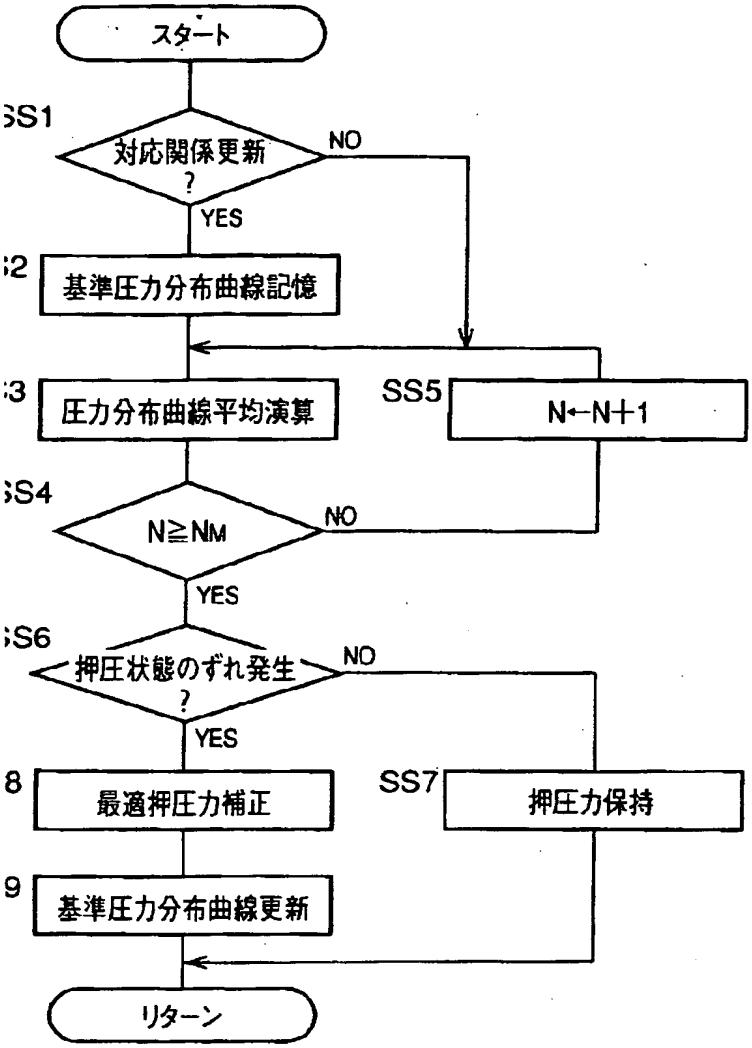

メインルーチン
S1
YES
キャリブレーション周期?
NO
S2
APS起動条件成立?
NO
YES
S3
YES
HDP起動条件成立?
NO
S4
APS制御ルーチン
S5
HDP制御ルーチン
S6
カフによる血圧測定
S7
対応関係決定
S8
NO
圧脈波入力?
YES
S9
推定血圧値MBP決定・表示

awing 12]



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